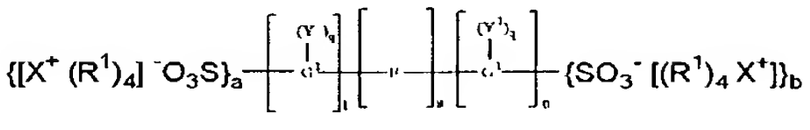
Claims

[c1] 1.A quaternary onium aromatic sulfonate having the formula:



,

wherein each R^1 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, each X is selected from the group consisting of phosphorus and nitrogen; "a" is 0, 1 or 2, and "b" is 0, 1 or 2 with the proviso that (a + b) is an integer greater than or equal to 1; G^1 is an aromatic group; E comprises a bis(carbonyloxyalkyl) polydiorganosiloxane, a bis (carbonyloxyaryl) polydiorganosiloxane, and an ether linkage; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, alkenyl, allyl, halogen, bromine, chlorine; nitro; and OR, wherein R is a monovalent hydrocarbon group; "q" represents any integer from and including zero through the number of positions on G^1 available for substitution; "t" represents an integer equal to at least one; "s" represents an integer equal to either zero or one; and "u" represents any integer including zero; with the proviso that when E is an ether linkage, then X is phosphorus.

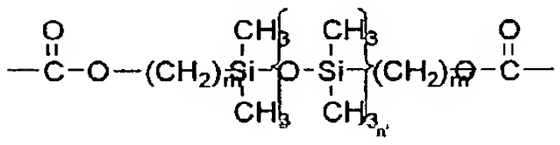
[c2] 2.The quaternary onium aromatic sulfonate of Claim 1, wherein each R^1 is an n-butyl radical, "X" is phosphorus, "E" is an ether linkage, "a" has a value of 0 or 1 and "b" has a value of zero or one with the proviso that (a+b) is equal to 1 or 2; R^1 is an n-butyl radical, "s", "t", and "u" each represents an integer equal to one; G^1 is a tri- or tetra-substituted phenyl radical, "q" represents an integer equal to one, and each Y^1 independently comprises C_1 to C_{20} linear and branched alkyl groups.

[c3] 3.The quaternary onium aromatic sulfonate of Claim 1, wherein each R^1 is an n-butyl radical, "X" is nitrogen, "a" has a value of 1 or 2 and "b" has a value of zero; "s" represents an integer equal to one, "t" and "u" each represents an integer equal to zero; G^1 is a tetravalent phenyl radical, and "q" represents an integer equal to two such that Y^1 is a methoxy and an n-pentadecyl group.

[c4] 4.The quaternary onium aromatic sulfonate of Claim 1, wherein each R^1 is an n-butyl radical, X is phosphorus, "a" has a value of 1 or 2 and "b" has a value of

zero; "s" represents an integer equal to one, "t" and "u" each represents an integer equal to zero; G^1 is a tetravalent phenyl radical, and "q" represents an integer equal to two such that Y^1 is a methoxy and an n-pentadecyl group.

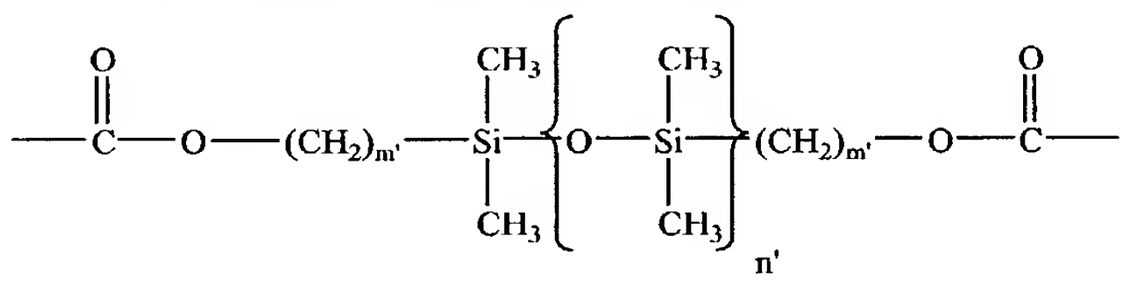
[c5] 5.The quaternary onium aromatic sulfonate of Claim 1, each R^1 is an n-butyl radical, "a" and "b" each has a value of 1, X is phosphorus, "s", "t" and "u" each represents an integer each being equal to one, G^1 is a divalent aromatic radical, "q" represents an integer equal to zero, and "E" is a bis (carbonyloxyalkyl)polydiorganosiloxane linkage of the formula:



,

wherein "m'" has a value in the range from about 3 to about 6, and "n'" has a value from about 5 to about 20.

[c6] 6.The quaternary onium aromatic sulfonate of Claim 1, wherein each R^1 is an n-butyl radical, "a" and "b" each has a value of 1, X is nitrogen, "s", "t" and "u" each represents an integer each being equal to one, G^1 is a divalent aromatic radical, "q" represents an integer equal to zero, and "E" is a bis (carbonyloxyalkyl)polydiorganosiloxane linkage of the formula:

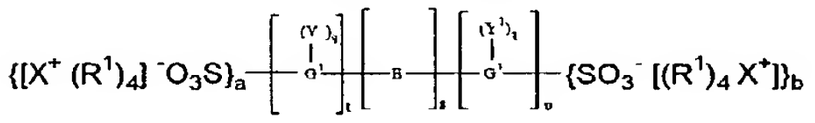


,

wherein "m'" has a value in the range from about 3 to about 6, and "n'" has a value in the range from about 5 to about 20.

[c7] 7.An antistatic or antidust composition comprising a melt blend of:

an aromatic sulfonate compound and a thermoplastic polymer, wherein the aromatic sulfonate compound is represented by the formula:



,

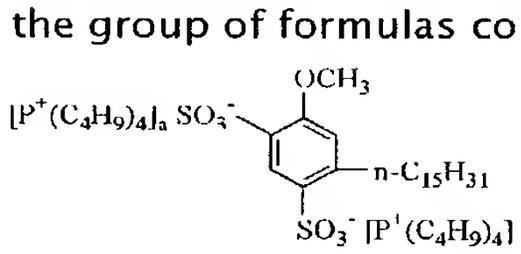
wherein each R^1 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, each X is selected from the

group consisting of phosphorus and nitrogen; wherein "a" is 0, 1 or 2, and "b" is 0, 1 or 2 with the proviso that (a + b) is an integer greater than or equal to 1; G^1 is an aromatic group; E comprises a bis(carbonyloxyalkyl) polydiorganosiloxane, a bis(carbonyloxyaryl) polydiorganosiloxane, and an ether linkage; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, alkenyl, allyl, halogen, bromine, chlorine; nitro; and OR, wherein R is a monovalent hydrocarbon group; "q" represents any integer from and including zero through the number of positions on G^1 available for substitution; "t" represents an integer equal to at least one; "s" represents an integer equal to either zero or one; and "u" represents any integer including zero; with the proviso that when E is an ether linkage, then X is phosphorus.

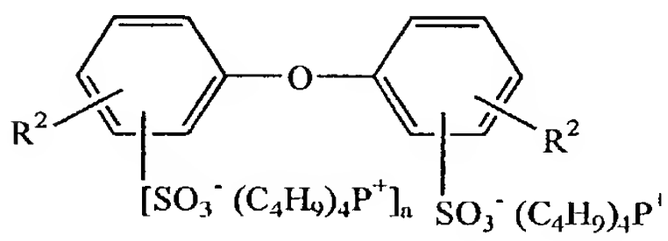
[c8] 8.The composition of Claim 7, wherein said aromatic sulfonate compound is about 2.5×10^{-3} parts to about 6 parts per 100 parts of the thermoplastic polymer.

[c9] 9.The composition of Claim 7, wherein said thermoplastic polymer comprises a polycarbonate, polyestercarbonate, polyphenylene sulfide, polyetherimide, polyester, polyphenylene ether, polyphenylene ether/styrene polymer blends, polyamide, polyketone, acrylonitrile-butadiene-styrene copolymer, styrene-acrylonitrile copolymer, polyolefin, blends thereof, and blends thereof with other materials.

[c10] 10.The composition of Claim 7, wherein the aromatic sulfonate compound is selected from the group of formulas consisting of:



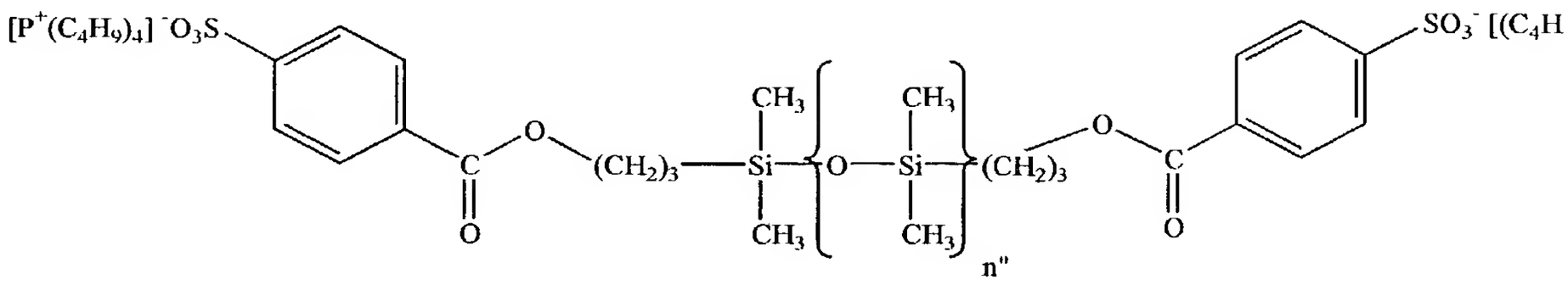
,



,

wherein "a" has a value of about zero or one, R^2 can occupy an ortho or a para position on the aromatic ring, and is independently selected from the group consisting of C_6 to C_{20}

linear and branched alkyl radicals; and



,

wherein "n"" has a value of about 7, and mixtures thereof.

[c11] 11.A molded or blown article comprising the composition of Claim 7.

[c12] 12.A coating composition comprising the composition of Claim 7.

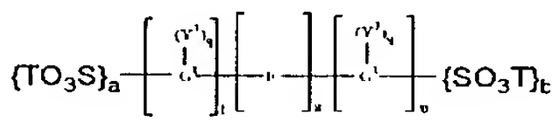
[c13] 13.A film comprising the composition of Claim 7.

[c14] 14.A fiber comprising the composition of Claim 7.

[c15] 15.A fabric comprising the fiber of Claim 14.

[c16] 16.A method of making a quaternary onium aromatic sulfonate compound comprising:

preparing in a solvent a first solution comprising an aromatic sulfonic acid salt having the formula:



,

wherein "T" is an alkali metal, "a" is 0, 1 or 2, and "b" is 0, 1 or 2 with the proviso that (a + b) is an integer greater than or equal to 1; G^1 is an aromatic group; "E" is an ether linkage; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, halogen, and OR, wherein "R" is a monovalent hydrocarbon group; "s", "t", and "u" each represents an integer equal to one, "X" is phosphorus and "q" represents any integer from and including zero through the number of positions on G^1 available for substitution;

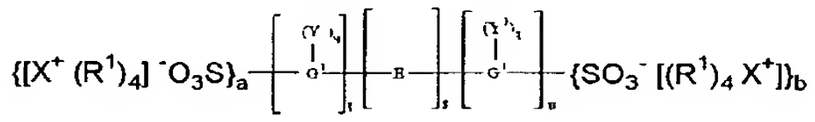
contacting the first solution with an acidic medium to convert the alkali metal aromatic sulfonic acid salt to an aromatic sulfonic acid;

mixing the aromatic sulfonic acid with a quaternary compound;

extracting the aromatic sulfonic acid and quaternary salt mixture with an

organic solvent to provide a second solution; and

evaporating the organic solvent from the second solution to obtain the quaternary onium aromatic sulfonate represented by the formula:



,

wherein each R^1 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, "a" has a value of 0, 1 or 2, and "b" has a value of 0, 1 or 2, with the proviso that (a+b) is greater than or equal to 1; G^1 is an aromatic group; "E" is an ether linkage; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, halogen, and OR, wherein "R" is a monovalent hydrocarbon group; "s", "t", and "u" each represents an integer equal to one, "X" is phosphorus and "q" represents any integer from and including zero through the number of positions on G^1 available for substitution.

[c17] 17.The method of Claim 16, wherein said alkali metal is selected from the group consisting of lithium, sodium, potassium, rubidium, and cesium.

[c18] 18.The method of Claim 16, further comprising maintaining a temperature at about 10^{o} C to about 50^{o} C during the method of making the quaternary onium aromatic sulfonate.

[c19] 19.The method of Claim 16, wherein the acidic medium is selected from the group consisting of strong mineral acids and strongly acidic type ion exchange resins.

[c20] 20.The method of Claim 16, wherein the quaternary compound is represented by formula:

$$X(R^4)_4\text{-}Y,$$

wherein X is phosphorus; each R^4 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals; and Y comprises hydroxide, $OCOR^5$, and OR^5, and wherein R^5 comprises aliphatic and aromatic, substituted or unsubstituted radicals.

[c21] 21.The method of Claim 16, wherein the quaternary compound comprises tetra-n-butylphosphonium hydroxide.

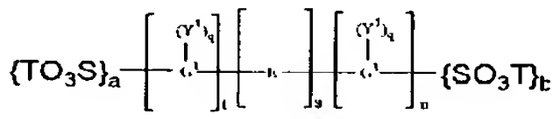
[c22] 22.The method of Claim 16, further comprising adjusting a pH of the first solution to about 4 to about 6.

[c23] 23.The method of Claim 16, wherein the solvent for said aromatic sulfonic acid salt comprises water, C_1-C_4 aliphatic alcohols, tetrahydrofuran, acetonitrile, C_7-C_9 aromatic hydrocarbons, or combinations containing at least one of these solvents.

[c24] 24.The method of Claim 16, wherein said organic solvent for extraction comprises halogenated aliphatic and aromatic compounds, aliphatic and aromatic hydrocarbons, cyclic and acylic ethers, and combinations containing at least one of these solvents.

[c25] 25.A method of making a quaternary onium aromatic sulfonate comprising:

preparing in a solvent a first solution comprising an aromatic sulfonic acid salt having the formula:



,

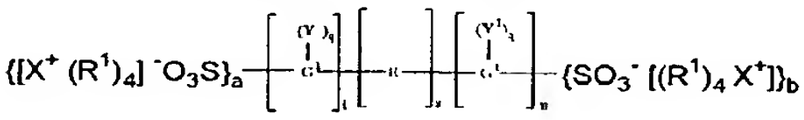
wherein "T" is an alkali metal, "a" has a value of 1 or 2, and "b" has a value of 0 ; G^1 is an aromatic group; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, halogen, and "OR", "R" is a monovalent hydrocarbon group; "s" and "u" each represents an integer equal to zero, "q" represents any integer from and including zero through the number of positions on G^1 available for substitution, "t" represents an integer equal to one;

contacting the first solution with an acidic medium to convert the alkali metal aromatic sulfonic acid salt to an aromatic sulfonic acid;

mixing the aromatic sulfonic acid with a quaternary compound;

extracting the mixture with an organic solvent to provide a second solution; and

evaporating the organic solvent from the second solution to obtain the quaternary onium aromatic sulfonate represented by the formula:



,

wherein each R^1 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, each "X" is selected from the group consisting of phosphorus and nitrogen; "a" has a value of 1 or 2 and "b" has a value of zero; G^1 is an aromatic group; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, alkenyl, allyl, halogen, bromine, chlorine; nitro; and OR, wherein "R" is a monovalent hydrocarbon group; "t" represents an integer equal to one; "s" and "u" each represents an integer equal to zero, and "q" represents any integer from and including zero through the number of positions on G^1 available for substitution.

[c26] 26.The method of Claim 25, wherein said alkali metal is selected from the group consisting of lithium, sodium, potassium, rubidium, and cesium.

[c27] 27.The method of Claim 25, further comprising maintaining a temperature of about 10^{o} C to about 50^{o} C during the preparation.

[c28] 28.The method of Claim 25, wherein the quaternary compound comprises the formula $X(R^4)_4$ –Y, wherein X is selected from the group consisting of phosphorus and nitrogen; each R^4 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals; and Y comprises hydroxide, $OCOR^5$, and OR^5, wherein R^5 independently comprises aliphatic and aromatic, substituted or unsubstituted radicals.

[c29] 29.The method of Claim 25, wherein the acid medium is an ion exchange resin bearing sulfonic acid groups.

[c30] 30.The method of Claim 25, wherein the quaternary compound is tetra-n-butylphosphonium hydroxide.

[c31] 31.The method of Claim 25, further comprising adjusting a pH of the first solution to about 4 to about 6.

[c32] 32.The method of Claim 25, wherein the solvent for said aromatic sulfonic salt comprises water, C_1 – C_4 aliphatic alcohols, tetrahydrofuran, acetonitrile, C_7 – C_9 aromatic hydrocarbons, and mixtures thereof.

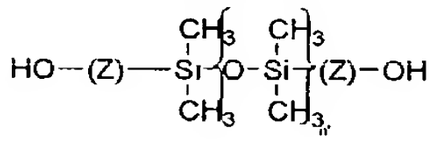
[c33] 33.The method of Claim 25, wherein said organic solvent for extraction comprises halogenated aliphatic and aromatic compounds, aliphatic and aromatic hydrocarbons, cyclic and acylic ethers, and mixtures thereof.

[c34]

34.A method of making a polyorganosiloxane-functionalized aromatic sulfonate comprising:

forming a reaction mixture comprising:

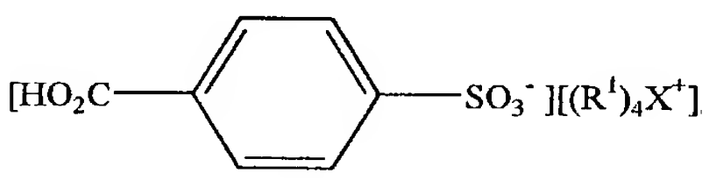
a hydroxyalkyl- or a hydroxyaryl-terminated polydimethylsiloxane represented by the formula:



,

wherein "Z" is selected from the group consisting of $(CH_2)_{m'}$, wherein "m'" has a value from about 2 to about 10, and divalent substituted and unsubstituted aromatic radicals; and "n'" has a value of about 5 to about 20;

a quaternary sulfonate salt of an aromatic sulfocarboxylic acid having the formula:



,

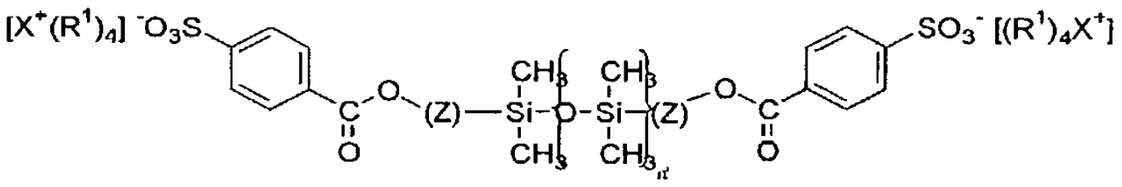
wherein each R^1 is independently selected from aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, and X is selected from the group consisting of phosphorus and nitrogen;

a catalyst composition, and

a solvent;

stirring the reaction mixture; and

heating the reaction mixture to a temperature and time effective to produce the polyorganosiloxane-functionalized aromatic sulfonate having the formula:



,

wherein each R^1 is independently selected from aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, and X is

selected from the group consisting of phosphorus and nitrogen; "Z" is selected from the group consisting of $(CH_2)_{m'}$, wherein "m'" has a value from about 2 to about 10, and divalent substituted and unsubstituted aromatic radicals; and "n'" has a value of about 5 to about 20.

[c35] 35.The method of Claim 34, wherein R^1 comprises an n-butyl group.

[c36] 36.The method of Claim 34, wherein the catalyst composition is selected from the group consisting of a carbodiimide compound of the formula:

$$R^6—N=C=N—R^6$$

,

wherein R^6 is independently selected from monovalent alkyl and aryl, substituted and unsubstituted radicals; 1-hydroxybenzotriazole, tertiary amines of the formula $(R^7)_3N$, wherein R^7 is independently selected from C_1-C_8 linear and branched alkyl groups; and a heterocyclic nitrogen base.

[c37] 37.The method of Claim 36, wherein the carbodiimide compound is selected from the group consisting of 1,3-dicyclohexylcarbodiimide, 1-[3-(dimethylamino)propyl]-3-ethylcarbodiimide hydrochloride, 1,3-diisopropylcarbodiimide, and mixtures thereof.

[c38] 38.The method of Claim 36, wherein the heterocyclic nitrogen base is selected from the group consisting of substituted and unsubstituted pyridine, imidazoles, pyrrolidines, and mixtures thereof.

[c39] 39.The method of Claim 34, wherein the solvent comprises C_1-C_4 aliphatic nitriles, dichloromethane, 1,2-dichloroethane, chlorobenzene, dichlorobenzene, and chlorotoluenes.

[c40] 40.The method of Claim 34, further comprising heating the reaction mixture to a temperature of about 50 ^{o}C to about a refluxing temperature of the reaction mixture for about 8 to about 30 hours.

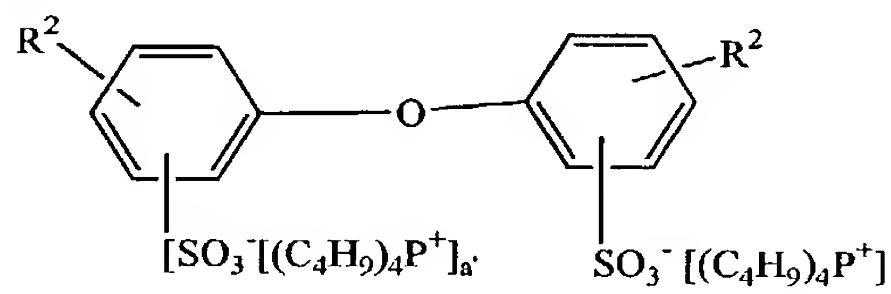
[c41]

41.A method of making a benzene-1-methoxy-3-(n-pentadecyl)-4,6-ditetrabutylphosphoniumsulfonate compound comprising:
contacting an aqueous solution of an alkali metal salt of a benzene-1-

methoxy-3-n-pentadecyl-4,6-disulfonic acid with a strongly acidic type ion exchange resin to generate a free acid of the alkali metal salt in the aqueous solution;
contacting the aqueous solution with tetra-n-butylphosphonium hydroxide in an amount effective to lower a pH of the solution to about 5 to about 6;
mixing the aqueous solution with an organic solvent;
separating the organic solvent from the aqueous solution; and
evaporating the organic solvent to obtain the benzene-1-methoxy-3-(n-pentadecyl)-4,6-ditetrabutylphosphoniumsulfonate compound.

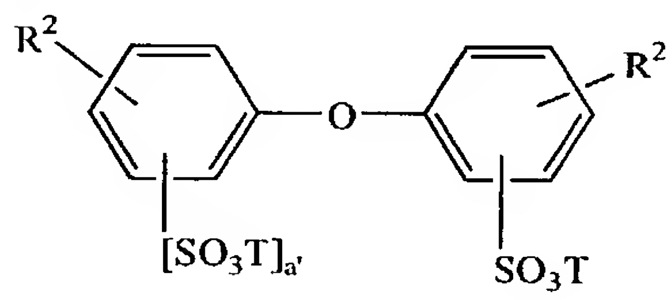
[c42]

42.A method of making an alkylated diphenyloxide tetrabutylphosphoniumsulfonate compound having the formula:



,

wherein "a'" has a value of zero or one, R^2 can occupy an ortho or a para position on the aromatic ring, and is independently selected from the group consisting of C_6 to C_{20} linear and branched alkyl groups; said method comprising:
contacting an aqueous solution with an acidic type ion exchange resin, wherein the aqueous solution comprises a compound represented by the formula:

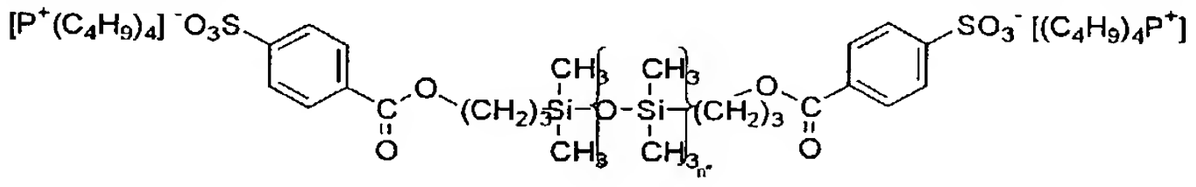


;

wherein "a'" has a value of zero or one, T is selected from hydrogen and sodium;
contacting the aqueous solution with tetra-n-butylphosphonium hydroxide in an amount effective to adjust a pH of the aqueous solution to about 5 to about 5.5;
mixing the aqueous solution with an organic solvent;
separating the organic solvent from the aqueous solution; and

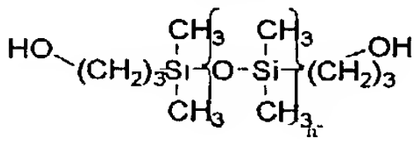
evaporating the solvent from the solution to obtain the alkylated diphenyloxide tetrabutylphosphoniumsulfonate compound.

[c43] 43.A method of making a bis(tetrabutylphosphonium) polyorganosiloxane-functionalized aromatic sulfonate compound having the formula:



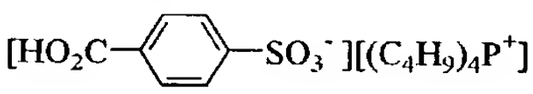
,

wherein "n"" is an integer having a value of about 7; said method comprising:
forming a reaction mixture comprising:
a hydroxyalkyl-terminated polydimethylsiloxane having the formula:



,

wherein "n"" is an integer with a value of about 7;
a quaternary sulfonate salt of an aromatic sulfocarboxylic acid having the formula,



,

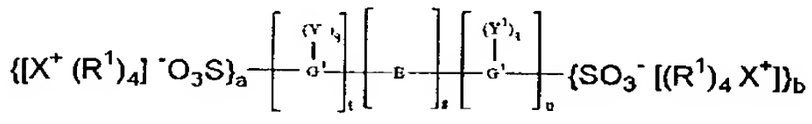
a catalyst composition comprising 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride, 1-hydroxybenzotriazole, and triethylamine;
a solvent; and
heating the reaction mixture to a temperature and for a time effective to produce the bis(tetrabutylphosphonium) polyorganosiloxane-functionalized aromatic sulfonate compound.

[c44] 44.The method of Claim 43, wherein the temperature is maintained from about 50 ^{o}C to the refluxing temperature of the reaction mixture.

[c45] 45.The method of Claim 43, wherein said solvent comprises C_1-C_4 nitriles, dichloromethane, 1,2-dichloroethane, chlorobenzene, dichlorobenzene, and chlorotoluenes.

[c46] 46.A method of making an antistatic or antidust thermoplastic polymer molding composition comprising:

dry-blending an aromatic sulfonate compound with a thermoplastic resin to produce a molding composition, wherein the aromatic sulfonate compound is represented by the formula:



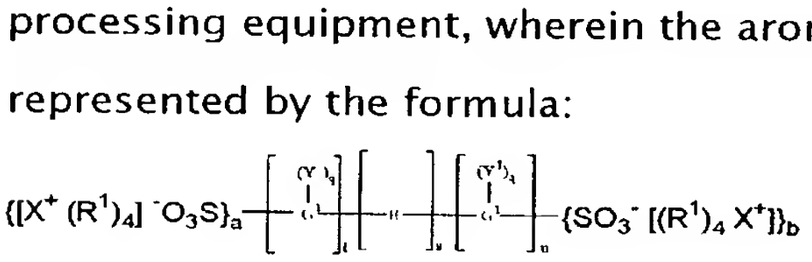
,

wherein each R^1 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, each X is selected from the group consisting of phosphorus and nitrogen; wherein "a" is 0, 1 or 2, and "b" is 0, 1 or 2 with the proviso that (a + b) is an integer greater than or equal to 1; G ^{1} is an aromatic group; E comprises a bis(carbonyloxyalkyl) polydiorganosiloxane, a bis(carbonyloxyaryl) polydiorganosiloxane, and an ether linkage; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, alkenyl, allyl, halogen, bromine, chlorine; nitro; and OR, wherein R is a monovalent hydrocarbon group; "q" represents any integer from and including zero through the number of positions on G^1 available for substitution; "t" represents an integer equal to at least one; "s" represents an integer equal to either zero or one; and "u" represents any integer including zero; with the proviso that when E is an ether linkage, then X is phosphorus.

[c47]

47.A method of making an antistatic or antidust thermoplastic polymer molding composition comprising:

combining an aromatic sulfonate compound with a thermoplastic resin melt processing equipment, wherein the aromatic sulfonate compound is represented by the formula:



,

wherein each R^1 independently comprises aliphatic or aromatic, substituted or unsubstituted, carbocyclic or heterocyclic radicals, each X is selected from the group consisting of phosphorus and nitrogen; wherein "a" is 0, 1 or 2, and "b" is 0, 1 or 2 with the proviso that (a + b) is an integer greater than or equal to 1; G ^{1} is an aromatic group; E comprises a bis(carbonyloxyalkyl) polydiorganosiloxane, a bis(carbonyloxyaryl) polydiorganosiloxane, and an

ether linkage; each Y^1 independently comprises hydrogen, a monovalent hydrocarbon group, alkenyl, allyl, halogen, bromine, chlorine; nitro; and OR, wherein R is a monovalent hydrocarbon group; "q" represents any integer from and including zero through the number of positions on G^1 available for substitution; "t" represents an integer equal to at least one; "s" represents an integer equal to either zero or one; and "u" represents any integer including zero; with the proviso that when E is an ether linkage, then X is phosphorus.